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Peer-reviewed author version

Martinho, Tiago; CAEKEBEKE, Pieter; Verstuyft, Lotte & van Riet, Roger (2024)
Revision radiocapitellar arthroplasty by mismatched implant components - A salvage
option: A report of two cases with a minimum three-year follow-up. In: Shoulder & Elbow,.

DOI: 10.1177/17585732241297152

Handle: <http://hdl.handle.net/1942/45052>

Revision Radiocapitellar Arthroplasty by Mismatched Implant Components – A Salvage Option: A Report of 2 Cases with Minimum 3 Years Follow-up

ABSTRACT

Radiocapitellar arthroplasty has been shown to improve pain and function in patients with a degenerative joint. Due to problems with loosening of the radial head component, one of the few available systems was removed from the global market. This offered specific challenges in terms of treatment strategies when one or both components of a system that is no longer available fail. Due to the very different geometry of the capitellar implant, revision of the capitellar component would require a complex procedure, likely requiring bone graft and a high chance of early failure, leaving resection or interposition arthroplasty as the only available options. Although implant mismatch is common practice in hip and knee arthroplasty with satisfactory results, it should remain a salvage option as off-label use of components gives rise to several medicolegal implications. We report two cases of radiocapitellar arthroplasty partial revision, by replacing only the radial head component by an implant from another system, while keeping the well-fixed original capitellar component in place. At a minimum of three years follow-up, both cases improved from poor to good and excellent Mayo elbow performance scores. There were no signs of implant failure on standard radiographs.

INTRODUCTION

Isolated symptomatic radiocapitellar degenerative changes are relatively rare ^{1, 2} and are mostly idiopathic or post-traumatic in origin. ³ When conservative treatment fails, available surgical options are limited. ⁴

The first radio-capitellar arthroplasty (RCA), the Lateral Resurfacing Elbow (LRE) (LRE system, Oxford, UK), was introduced in 2005, followed soon after by the UniElbow System (UES) (Stryker, Morrisville, USA). The third RCA that was developed was a custom (Stryker, Morrisville, USA). In all implant designs, the RCA consists of a radial head (RH) component with a polyethylene (PE) surface that articulates with a metal capitellar component. The main difference between these systems is that the LRE can be considered as a resurfacing arthroplasty as it requires only reaming of degenerative joint surfaces, while the UES and custom system are replacement arthroplasties that entail both RH and capitellar resection.

The advent of RCA was intended to fill the gap in the surgical management of young patients with degenerative or non-reconstructible joints. ⁵⁻⁷ The literature on the outcome after RCA is scarce and mostly based on small cases series. ⁸⁻¹² If the available studies show significant improvements in pain, range of motion and stability, the complication rate is also significant. Notably, the increased risk of early loosening of the UES RH component led to its removal from the global market in 2017. Since then, there have been no other options from the same system to revise a RCA failure which offers specific challenges in terms of treatment strategies.

We report two cases of loosening of the UES RH component treated by revision with a bipolar cemented long-stem RH implant with a PE articulating surface, from another system while retaining the well-fixed capitellar component. Patient gave their written informed consent to this procedure.

CASE REPORTS

Case 1: A 50-year-old male patient with ankylosing spondylitis was initially treated at another institution by arthroscopic debridement, synovectomy, and loose body removal for a painful loss of function of his right dominant elbow. Primary isolated end-stage RC osteoarthritis was confirmed arthroscopically. As his symptoms did not improve, a RCA with the UES was performed five months later. Postoperatively, the elbow remained painful. Successive standard radiographs showed an overlengthening and progressive loosening of the RH component (Figure 2). Fourteen months after RCA, it was decided to remove the loose RH component and, as a revision with the same system was no longer possible, the surgeon decided to perform an anconeus interposition arthroplasty. This did not resolve the patient's symptoms, and he was referred to the senior author (RVR) one year after the implant had been removed. At this point, the patient reported visual analog scale (VAS) for pain was 9, with a 20 degrees extension deficit and flexion up to 120 degrees. Pronation and supination were limited to 10 degrees in both directions, with clear proximal radioulnar impingement and valgus instability (Figure 3). The Mayo elbow performance score (MEPS) was poor with a score of 25. We considered this to be a failure of the anconeus interposition arthroplasty and after discussion of available options with the patient, it was decided, to re-implant a RH component from another system, using a bipolar cemented long-stem implant with a polyethylene articulating surface (CRF-II® prosthesis (Tornier, Montbonnot, France), whilst retaining the original capitellar component. The patient was positioned supine with the arm on a side table and a sterile tourniquet applied. The previous lateral incision was resumed and extended as needed. Access to the joint was obtained via an extensor split approach. The medullary canal was prepared according to the manufacturer's recommendations. The height of the implant was determined according to the small sigmoid notch¹³. The definitive implant was placed with the prosthesis neck oriented towards Lister's tubercle to ensure correct rotational alignment.

At final follow-up, 36 months postoperatively, the patient had a VAS for pain of 2, MEPS of 85 (good), flexion was 120 degrees and extension improved to 10 degrees. Pronation and supination returned to normal with a range of 85° and 90° respectively. The elbow was stable, the radioulnar impingement had resolved completely and there was no radiographic evidence of implant loosening (Figure 4).

Case 2. A 58-year-old male patient presented with pain and stiffness of his left dominant elbow, six months after a minimally displaced radial head fracture. He underwent an arthroscopic debridement showing a diffuse full thickness loss of RC cartilage. Postoperatively, ROM returned to normal, but pain persisted. Intra-articular infiltration of hyaluronic acid resulted in a temporary decrease in pain. Radiographically there was a progression of degenerative changes and pain increased. Two years after the arthroscopy, a RCA was performed. After an initial positive result, a painful progressive loosening of the RH component occurred and led to a failure of the implant at 37 months after the index procedure (Figure 5). It was decided to revise the radial head component as described in the previous case. Before revision surgery, the patient had a VAS for pain of 7, and a MEPS of 55 (poor). The elbow was stable with a fixed flexion deformity of 5 degrees and flexion to 130 degrees. Pronation and supination were 80 degrees in both directions. At the last follow-up at 37 months postoperatively, he had a VAS for pain of 0 to 1 and a MEPS of 100. Elbow ROM and stability were unchanged from the pre-revision status (Figure 6).

DISCUSSION

These two cases illustrated significant improvement in pain and overall function more than three years after RCA partial revision by mismatched implants for painful loosening of the RH component.

RCA revision remains a challenge, as little is known about replacing one or both components. To add complexity, one of the previously available systems, the UES, has since been discontinued as the rHead prosthesis (Stryker, Morrisville, USA), corresponding to the UES RH component, was at increased risk of early loosening¹⁴. Unsurprisingly, painful loosening of the RH component was also the main complication of the UES, with rates of up to 29%⁸⁻¹². The rHead (Stryker, Morrisville, USA) and CRF-II (Tornier, Montbonnot, France) prostheses are both modular, with a bipolar CoCr head and an internal polyethylene coating. While the former has a short press-fit stem, the latter has a long-cemented stem^{15, 16}. This difference in design and fixation technique of the RH component could be at the root of the presented results.

Implant mismatch is common practice worldwide in hip and knee arthroplasty. It is generally done in the interest of the patient, aiming to optimize treatment outcome. However, off-label use of components gives rise to several medicolegal implications¹⁷. Furthermore, the EFORT implant and Patient Safety Initiative acknowledged that, under certain circumstances, patients may benefit from selective mismatch applications¹⁸. It is crucial to balance the risks and benefits to the patient, obtain informed consent, and document the decision-making process appropriately. Moreover, surgeons must be fully aware of the features of the components that they use during mismatch applications and only combine implants that are compatible. In the presented cases, our decision to perform a partial revision of the UES with a RH implant from another system was driven by patients' age and functional demand, the absence of capitellar component involvement and UH OA as well as the failure of various other treatment modalities. The decision was taken jointly with the patient, who was fully informed that this was a salvage option.

Other surgical treatment modalities could include implant removal⁴ with or without a concomitant anconeus or Achilles interposition arthroplasty^{19, 20} as well as revision to

a total elbow arthroplasty (TEA). While the latter is not indicated in an active population without ulnohumeral (UH) OA, implant removal alone, similar to a RH resection, and interposition arthroplasty have proven effective in treating failed RH arthroplasties^{21, 22}. In a retrospective multicenter study of 28 failed RH arthroplasties, Barret et al²³ observed that implant removal alone and RH arthroplasty revision improved pain and function with similar results at a mean follow-up of more than 5 years. Similarly, Baghdadi et al²⁴ found an improvement in pain and function in their retrospective analyses of 29 anconeus interposition arthroplasties at a mean follow-up of 10 years. In addition, the authors included two cases of RCA for which they reported mild and moderate pain and a MEPS of 70 and 85 points, respectively. Unfortunately, this procedure did not lead to an acceptable outcome in our first case, who developed persistent pain, valgus instability and a clear proximal radioulnar impingement, illustrating its potentially less predictable clinical outcomes^{25, 26}.

Compared to the latter, RCA has clear benefits like restoring elbow kinematics when the ulnar collateral ligament remains intact²⁷ and theoretically postpone the need for a TEA. However, the literature lacks comparative data and long-term outcomes between these different techniques. Pending evidence of the superiority of one strategy over another, the treatment plan should be tailored to the cause of RCA failure, as well as to surgeon and patient preferences. As the low volume of RCA makes it commercially less interesting to develop, partial revision by mismatched implants may become a definite solution in the absence of further options.

CONCLUSION

Failure of a RCA remains a challenge. Little is known about replacing one or both components and overall treatment options are limited. Although RCA partial revision by mismatched implants is a salvage option, it appears to be a viable alternative for retaining a RCA. To our knowledge, these are the first cases of RCA partial revision by implant mismatch. At a medium-term follow-up, both cases had mild pain, a good to excellent MEPS, a functional arc and a stable elbow. In addition, there were no signs of loosening on standard radiographs.

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FIGURE 1: Radial head component with a polyethylene articulating surface from the CRF-II® prosthesis (Tornier, Montbonnot, France).

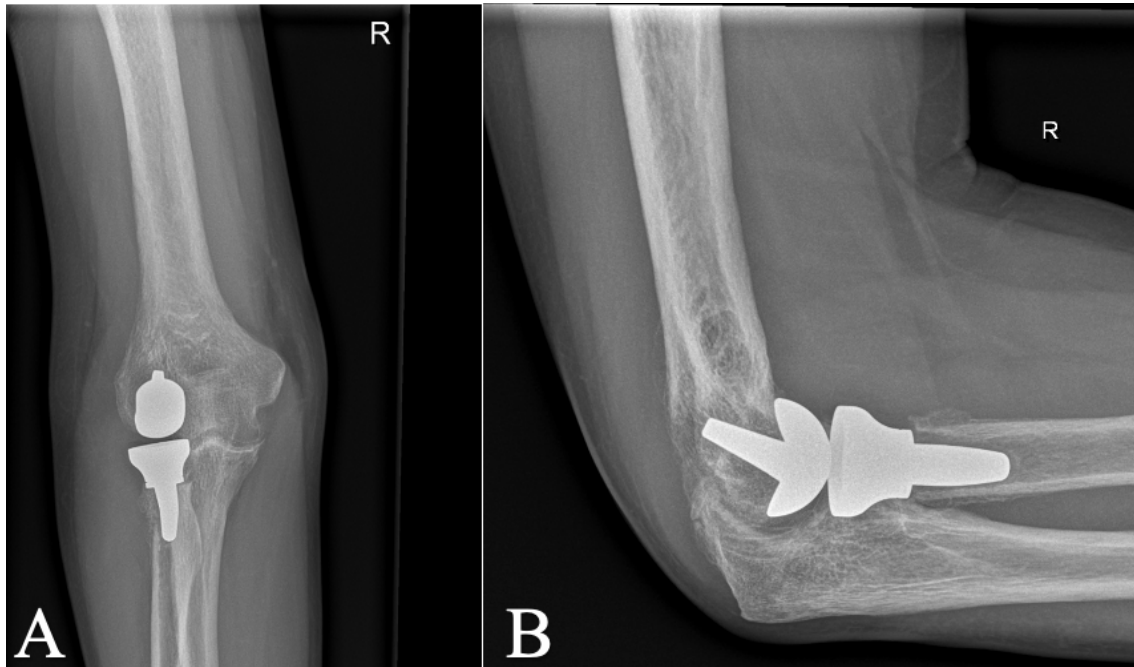


FIGURE 2 : Anteroposterior (A) and lateral (B) standard radiographs of the right elbow of case 1, 12 months after radiocapitellar arthroplasty with UniElbow system (Stryker, Morrisville, USA). While the capitellar component appears well fixed in a correct position, the radial head component shows signs of overstuffing and progressive loosening.



FIGURE 3: Computed tomography scan illustrating the first revision of the Radiocapitellar arthroplasty of case 1 by radial head component removal and anconeus interposition arthroplasty. Clear radioulnar impingement is visible.

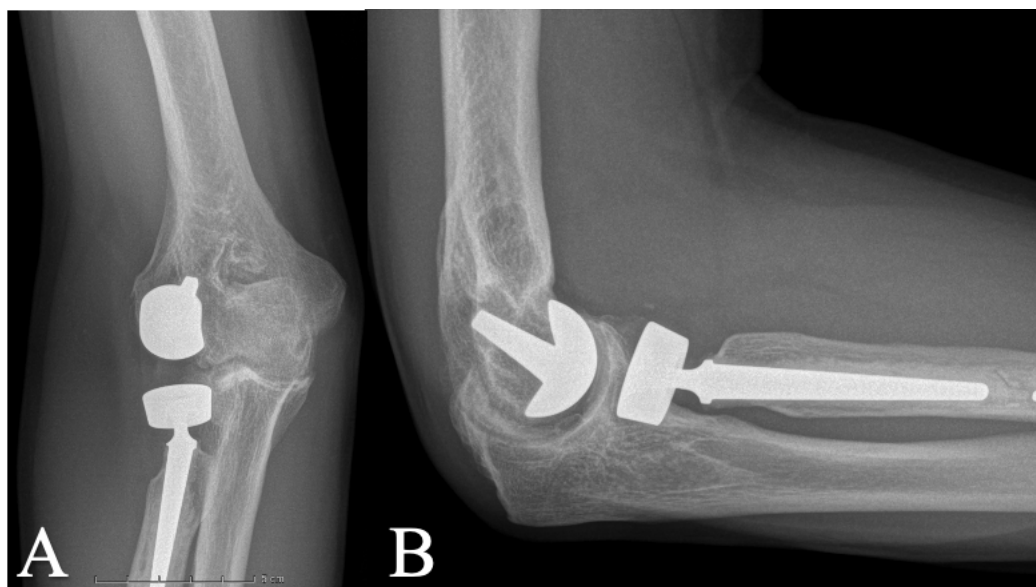


FIGURE 4 : Anteroposterior (A) and lateral (B) standard radiographs of the right elbow of case 1 27 months after revision of the radial head component of the UniElbow system (Stryker, Morrisville, USA) with a bipolar cemented long-stem implant with a polyethylene articulating surface)CRF-II® prosthesis (Tornier, Montbonnot, France) whilst retaining the capitellar component. At follow-up both components are in good position without any signs of loosening.

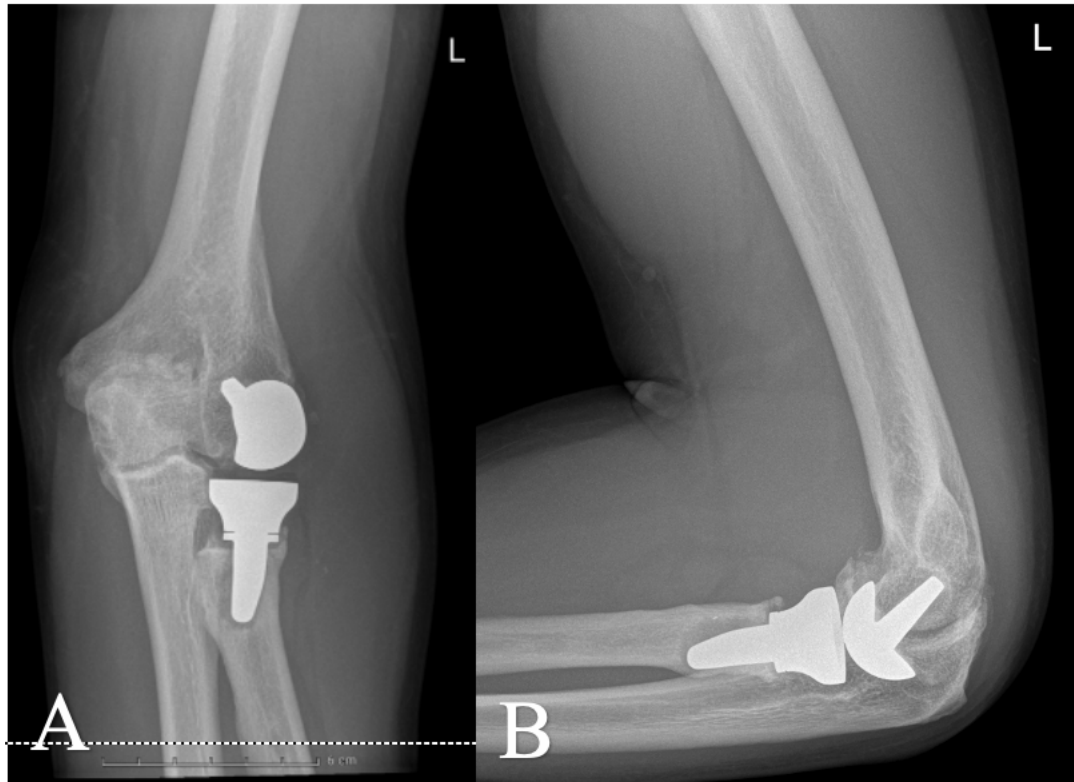


FIGURE 5 : Anteroposterior (A) and lateral (B) standard radiographs of the left elbow of case 2 36 months after radiocapitellar arthroplasty with UniElbow system (Stryker, Morrisville, USA). While the capitellar component appears well fixed in a correct position, the radial head component shows signs of progressive loosening.

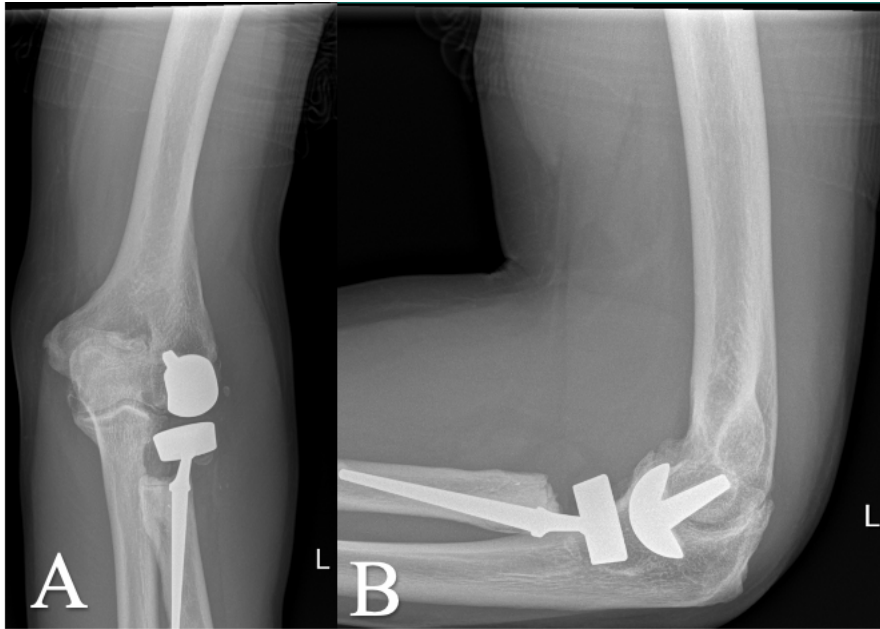


FIGURE 6 : Anteroposterior (A) and lateral (B) standard radiographs of the right elbow of case 2 36 months after revision of the radial head component of the UniElbow system (Stryker, Morrisville, USA) with a bipolar cemented long-stem implant (CRF-II® prosthesis (Tornier, Montbonnot, France) with a polyethylene articulating surface whilst retaining the capitellar component. At follow-up, both components remained in good position without any signs of loosening.